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IS 12342-2 (1988): Raw Seaweeds, Part 2: Alginophytes [FAD
8: Food Additives]



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“Knowledge is such a treasure which cannot be stolen”

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(Reaffirmed 2004)

*Indian Standard***SPECIFICATION FOR
RAW SEAWEEDS****PART 2 ALGINOPHYTES****0. Foreword**

0.1 Seaweeds for commercial usage are classified into two types:

- a) Agarophytes which are the agar-yielding seaweeds, and
- b) Alginophytes which are the alginate-yielding seaweeds.

This standard is being dealt with in the following two parts:

- Part 1 Agarophytes
- Part 2 Alginophytes

0.2 This part (Part 2) covers alginophytes. Alginophytes are harvested regularly from natural habitats. Till today aqua-cultured species have not been used to produce alginate in India. Different species have different quality and quantity of alginate. Seasonal variations have also been observed.

0.2.1 A method for determining the quality index and the basis of price fixation has been given in Appendix A for guidance.

1. Scope — This standard (Part 2) prescribes the requirements and methods of sampling and test for alginophytes (raw alginate-yielding seaweeds).

2. Types and Grades — This part (Part 2) covers alginophytes of *Sargassum* and *Turbinaria* species which shall be of the following two grades:

- a) Grade I, and
- b) Grade II.

3. Requirements

3.1 Description — The dried seaweed shall be in whole or powder form. It shall be light brown or dark brown in colour and shall have a characteristic smell of dried seaweeds. The material shall be free from objectionable or rancid odour and insect infestation. The material shall not be charred (sometimes charring takes place during storage).

3.2 Identification — The material shall be identified by the description given in Appendix B.

3.3 The material shall also comply with the requirements given in Table 1.

4. Packing, Storage and Marking

4.1 Packing — The material (powder or whole) shall be packed in plastic-lined hessian, craft paper or plastic-thread woven gunny bags. It shall be stitched properly to protect the material from moisture and humidity.

4.2 Storage — The material shall be stored in a cool dry place so as to avoid excessive exposure to heat and light.

Adopted 16 March 1988

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TABLE 1 REQUIREMENTS FOR ALGINOPHYTES

(Clause 3.3)

SI No.	Characteristic	Requirements				Method of Test, Ref to Appendix
		Sargassum		Turbinaria		
		Grade I	Grade II	Grade I	Grade II	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Alginic acid, percent by mass, <i>Min</i>	25	15	25	15	C-1
ii)	Viscosity* centipoises, <i>Min</i>	190	150	150	100	C-2
iii)	Molsture, percent by mass, <i>Max</i>	15	20	18	20	C-3
iv)	Dirt, dust, mud and sand, percent by mass, <i>Max</i>	5	7	5	7	C-4
v)	Other seaweeds, percent by mass, <i>Max</i>	3	5	3	5	C-5

*Viscosity of one percent sodium alginate solution at 27°C.

4.3 Marking — Each bag shall be suitably marked with the following information:

- Name of the seaweed,
- Name and address of the supplier;
- Net mass,
- Month and year of collection, and
- Any other requirement laid down under Standards of Weights and Measures (Packaged Commodities) Rules, 1977.

4.3.1 Standard marking — Details available with the Bureau of Indian Standards.

5. Sampling

5.1 Unless otherwise agreed to between the buyer and the seller, the sampling plan given in IS : 2500 (Part 1)-1973 'Sampling inspection tables: Part 1 Inspection by attributes and by count of defects (*first revision*)' may be followed. The inspection level and acceptable quality level (AQL) for various requirements shall be as given in 5.1.1 and 5.1.2.

5.1.1 For alginic acid and viscosity, a single sampling plan with inspection level III and AQL of 2.5 percent [see Tables 1 and 2 of IS : 2500 (Part 1)-1973] shall be used.

5.1.2 For the remaining requirements, a composite sample made out of the bags examined according to 5.1.1 and found satisfactory shall be tested. All the test results on the composite sample shall meet the corresponding specification requirements.

6. Tests

6.1 Tests shall be carried out by the methods specified in 3.2 and Table 1.

6.2 Quality of Reagents — Unless specified otherwise, pure chemicals and distilled water (see IS : 1070-1977 'Specification for water for general laboratory use (*second revision*)' shall be employed in tests.

Note — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

APPENDIX A

(Clause 0.2.1)

DETERMINATION OF QUALITY INDEX AND PRICE FIXATION

A-1. Within the limits of recommended levels of seaweed constituents and impurities, a formula has been designed by which one can calculate the quality index (QI) of different seaweeds. The quality indices will be comparable for a particular type of phycocolloid produced by the same or different species.

$$\text{Quality index} = \frac{\text{Content of phycocolloid (percent)} \times \text{Quality Unit}^*}{\text{Total impurities}^\dagger, \text{ percent}}$$

*Viscosity, in centipoises, of 1 percent sodium alginate at 27°C.

†Adhered foreign materials like dirt, dust, mud and sand or adulteration by unwanted seaweeds, moisture, etc.

A-2. Based on this index, different types of seaweeds can be compared and their market value fixed. For example, *Sargassum* of Grade I quality having 35 percent alginate, 125 cp viscosity and 9 percent impurities (7 percent moisture, 1 percent dirt, dust, etc, and 1 percent unwanted seaweeds) will have a QI of 486 while second grade *Sargassum* having 25 percent alginate, 70 cp viscosity and 18.5 percent impurities (14 percent moisture, 3 percent dirt, dust, etc, and 1.5 percent unwanted seaweeds) will have a QI of 95. Both the quality indices are in the ratio of 5:1. Therefore, the market value of Grade I *Sargassum* should be five times that of Grade II quality.

APPENDIX B

(Clause 3.2)

IDENTIFICATION

B-1. Plants are with thalloid structure having chlorophyll a and simple reproductive structures. Plants are without an alternation of generation. Axes are terete, bearing distinct foliar organs; vesicles, usually present, are lateral or immersed in the terminal branchlets.

B-1.1 *Sargassum* — Foliar organs are very narrow and branched, or broader leaflike, with a distinct costa; vesicles and fertile branches are lateral and auxillary, or the latter in terminal panicles.

B-1.1.1 Plants are with a lobed hold fast, cylindrical or flattened with broad to filiform leaves, with lateral stalked bladders, receptacles are auxillary or paniculate.

B-1.2 *Turbinaria* — Foliar organs are turbinate or obpyramidal, often with a vesicle in the distal end and often with distal, marginal and longitudinal spine-bordered ridges; fertile branches crowded auxillary.

B-1.2.1 Plants have a rhizomorphous base, branches are erect and freely branched, smooth or with tuberculate scars; bearing numerous obovate or obpyramidal peltate foliar organs. Auxillary fruiting branches in the leaf axils.

APPENDIX C

(Table 1)

METHOD OF TEST FOR ALGINOPHYTES

C-1. Alginic Acid

C-1.1 Procedure

C-1.1.1 Weigh 50 g dry seaweed powder (60 mesh particle size) and soak overnight in one litre of 0.2 N hydrochloric acid. Filter the residue and wash with distilled water till the chloride ions are removed. Transfer the residue to a beaker and add one litre of 3 percent sodium carbonate. Stir it well. Place in an oven, maintained at $50 \pm 1^\circ\text{C}$ for 2 hours. Leave overnight at room temperature. Centrifuge at 1 000 rpm for half an hour. Collect the filtrate. Again extract the residue with half litre of 1.5 percent sodium carbonate and centrifuge. Combine both the filtrates.

C-1.1.2 Take one litre solution of one percent calcium chloride in a beaker. Slowly add the filtrate (in the form of a fine jet) into the calcium chloride solution. Continuously stir the calcium chloride solution while adding the filtrate. Allow the resulting precipitate to settle. After 2 hours, add a small quantity of calcium chloride solution to test the complete precipitation of alginate. Filter the calcium alginate and wash it with distilled water till it is free from chloride. Transfer the calcium alginate to a beaker and slowly add 1 N hydrochloric acid. Stir it continuously, care has to be taken as frothing may be a problem. Keep adding 1 N hydrochloric acid till the whole solution is about pH 3 and conversion is complete. Allow the precipitated alginic acid to settle. Filter the alginic acid. Wash it with distilled water till it is free from chloride. Finally wash it with alcohol and dry it at 60°C in an oven till constant mass is obtained. Calculate the percentage of alginic acid. Triplicate samples shall be extracted in this way. The results of triplicate analysis should not vary by more than 2 percent. Take the mean of the triplicate value.

C-1.2 Calculation

$$\text{Alginic acid, percent by mass} = \frac{M_1}{M_2} \times 100$$

where

M_1 = mass, in g, of the alginic acid; and

M_2 = mass, in g, of the material taken for the test.

C-2. Determination of Viscosity

C-2.0 Principle — The resistance to movement of spindle is measured and expressed in terms of viscosity in seconds. The resistance, being directly linked with viscosity, can be expressed directly in terms of viscosity by previous calibration of the instrument.

C-2.1 Apparatus

C-2.1.1 Brookfield viscometer — Type LV or equivalent.

C-2.1.2 Mechanical stirrer

C-2.1.3 Constant Temperature Bath — maintained at 27°C.

C-2.2 Procedure

C-2.2.1 Determine the moisture content of the sample (see **C-3**). Calculate the mass of sample equivalent to 5 g dry mass, required to make 500 g of test solution as follows:

$$\text{Mass of sample, in g} = \frac{100 \times A}{100 - B}$$

where

A = desired dry mass of sample, in g (5 g in this case); and

B = moisture content, percent (see **C-3**).

C-2.2.2 Take the sample of sodium alginate in a jar and add 100 ml of distilled water. Bring the pH of the solution between 6 and 8 by adding hydrochloric acid or sodium hydroxide as the case may be and make up the solution to 500 g with distilled water. Place the stirrer in the solution so that the blade is about half way between the bottom of the jar and the surface of the liquid, stir till the sample is dissolved. Remove the agitator and transfer the sample container to the constant temperature bath and keep it there for three hours. Remove the sample container from the bath, stir it again and measure the viscosity with the Brookfield viscometer at 27°C using the spindle and speed given below:

Viscosity Range	Spindle No.	Speed, rev/min	Scale
100 to 200	1	30	100

C-2.2.3 Allow the spindle to rotate until a constant reading is obtained. Note the reading.

C-3. Moisture

C-3.1 Procedure — Take about 10 g air dried seaweed sample into a weighed porcelain dish. Weigh and place in an oven maintained at $105 \pm 2^\circ\text{C}$. Dry at this temperature for 6 hours. Cool in a desiccator and weigh. Carry out triplicate determinations for the samples collected at random from one lot. The results of triplicate readings should not vary by more than 1 percent. Determine the mean of triplicate results and calculate the moisture in percent.

C-3.2 Calculation

$$\text{Moisture, percent by mass} = \frac{(M_2 - M_1) \times 100}{M_2}$$

where

M_1 = mass, in g, of the material after drying for 6 hours; and

M_2 = mass, in g, of the material taken for the test.

C-4. Dirt, Dust, Mud and Sand

C-4.1 Procedure — Weigh 250 g air dried seaweed and soak it for 30 minutes in one litre of tap water (salt content not more than 300 mg/kg), in a beaker. Gently rub and agitate the seaweeds in the water to dislodge the adhered materials. Hand pick the seaweeds from the water. Then filter the water through double fold muslin cloth. Remove the insoluble matter from the cloth and keep it separately. Remove the fragments of seaweeds, if present. Keep the filtrate in another container. Again rewash the same seaweed with another one litre quantity of tap water. Separate the insolubles and filtrate as described earlier. Combine the two insoluble matters into one. Similarly combine the two filtrates into one.

C-4.1.1 Wash the insoluble matter with distilled water. Transfer the washed and dewatered insoluble materials into a weighed crucible and dry it at $105 \pm 2^\circ\text{C}$ in an oven and weigh.

C-4.1.2 Find the total volume of combined filtrate. Mix thoroughly and pipette 100 ml of the filtrate, with the help of volumetric pipettes. Transfer this aliquot to a previously weighed porcelain basin. Dry it completely on a water bath, then transfer it to muffle furnace maintained at $400 \pm 5^\circ\text{C}$. Maintain at this temperature for 6 hours. Remove the basin from the furnace when the temperature is about 150°C . Cool in a desiccator to room temperature and weigh. Calculate the quantity of inorganic materials for total combined filtrate. Calculate the percentage quantity of dirt, dust, mud and sand.

C-4.1.3 Make triplicate analysis for each lot. The samples should be collected at random. The results of the triplicate analysis should not vary by more than 5 percent. Calculate the mean of triplicate analysis.

C-4.2 Calculation

$$\text{Dirt, dust, mud and sand, percent by mass} = \frac{(M_1 + M_2) 100}{M}$$

where

M = mass, in g, of the material taken for test;

M_1 = mass, in g, of the insoluble matter (B-4.1.1); and

M_2 = mass, in g, of the inorganic matter (B-4.1.2).

C-5. Other Seaweeds — Contaminating weeds are generally green seaweeds like species of *Ulva*, *Rhizoclonium*, etc. Sometimes red seaweeds like *Hypnea* are also adulterants. This alga can be easily identified by its short cylindrical filaments with spiny appendages on main axis and sometimes the presence of hook shaped tendrils on the apex.

C-5.1 Procedure — Take 1 kg of air dried seaweed sample. Isolate the contaminants manually and determine their total weight. Calculate the percentage contaminants. Make triplicate determinations for the samples collected at random. The results of the triplicate readings should not vary by more than one percent. Calculate the mean of triplicate readings.

EXPLANATORY NOTE

Seaweeds are commercially utilized for the extraction of chemicals like alginic acid, sodium alginate (textile and pharmaceutical grades), and agar (food and microbiological grade). These products have widespread usage in food, pharmaceutical textile, confectionery, cosmetic and other industries. The raw seaweeds also have a good potential for export.

The availability of these seaweeds is less than the demand and, therefore, these are adulterated, the common adulterants being moisture, dirt, dust, mud, sand, etc., and low quality seaweeds of the same or different species. This standard has, therefore, been formulated to ensure availability of seaweeds of the desired quality.

Alginates are most extensively used in textile, paper and paint industries as well as in the food industries. They are also utilized as emulsifiers and stabilizers in dairy products (sherbats and in ice-creams to prevent ice crystal formation; chocolate milk, cheese puddings and toppings). Alginates are also used as thickeners in syrups, sauces, salad dressings, soaps, shampoos, tooth-pastes, shaving creams, lipsticks, insecticides, plastics, fireproofing fabrics and polishes. In medicine, they are used to make surgical threads that dissolve and do not have to be removed. A whole blood substitute is obtained in part from alginate, and this is used in emergency transfusions.

The following Indian Standards have been published on alginates for different uses:

IS : 5191-1969 Sodium alginate, food grade

IS : 6036-1970 Alginate dental impression material

IS : 10583-1983 Sodium alginate for textile industry

In the preparation of this standard, considerable assistance has been obtained from Central Salt and Marine Chemicals Research Institute, Bhavnagar.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.